

TENNESSEE RIVER AND TRIBUTARIES, NORTH CAROLINA, TENNESSEE, ALABAMA, AND KENTUCKY

[Prior Rept., H. Doc. No. 319, 67th Cong., 2d sess.]

LETTER

FROM

THE SECRETARY OF WAR

TRANSMITTING

A REPORT FROM THE CHIEF OF ENGINEERS ON PARTIAL SURVEY
OF THE TENNESSEE RIVER AND ITS TRIBUTARIES

JUNE 26, 1926.—Referred to the Committee on Rivers and Harbors and ordered
to be printed

WAR DEPARTMENT,
Washington, June 25, 1926.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

DEAR MR. SPEAKER: I am transmitting herewith a partial report dated the 24th instant, from the Chief of Engineers, United States Army, on survey of Tennessee River and its tributaries, authorized by the river and harbor acts of September 22, 1922, and March 3, 1925, and the act of April 15, 1926, together with accompanying papers.

Sincerely yours,

DWIGHT F. DAVIS,
Secretary of War.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, June 24, 1926.

Subject: Partial report on survey of Tennessee River and its tributaries.

To: The Secretary of War.

1. I submit herewith, for transmission to Congress, a partial report on the survey of the Tennessee River, authorized by the acts of September 22, 1922, March 3, 1925, and April 15, 1926. Submission

of a partial report is contemplated by the following clause in the latter act:

Provided, That reports of such survey or surveys may be made to the Congress from time to time, but the Engineer Department shall not give out information as to said surveys to other persons until after a report, partial or final, shall be made to the Congress.

2. At my instructions the district engineer prepared a letter, which is attached, containing a general statement of the work under way and of the situation in the Tennessee Valley as it appears to him. He also furnished copies of all data thus far collected by the field investigation.

3. This material was referred to the Board of Engineers for Rivers and Harbors, and attention is invited to its report herewith. The board gives a brief statement of the work which has been done, and of the work which is contemplated by the latest authorization. It recommends that there be transmitted to Congress the district engineer's letter and a list of the maps and other data which have been prepared.

4. After due consideration, I concur in the recommendation of the Board of Engineers for Rivers and Harbors. The material gathered in the course of the survey will be of much value to anyone interested in power development in the Tennessee Basin. The number of persons so interested is probably quite limited, and would not justify the expense of printing this voluminous material. It should, however, be made available to the public.

5. I therefore transmit herewith the report of the board, the letter of the district engineer, and a list of the maps, profiles, cross sections, discharge tables, hydrographs, duration and backwater curves, tables of reservoir capacity, area and volume diagrams, and miscellaneous diagrams and tabulations completed to date. Persons desiring copies of any of these may obtain them from the United States district engineer, 40 Municipal Building, Chattanooga, Tenn., at the prices indicated on the attached list.

6. I desire to emphasize that this partial report is not to be construed in any way as a recommendation regarding the future action of Congress in the matter of investigations to be made, or work to be done, beyond the limits of existing authorizations, regarding power, navigation or any other form of development in the Tennessee Basin. It is purely and simply a progress report, to keep Congress advised of the status of the matter, and to make possible, under the provisions of the above-quoted clause of the act of April 15, 1926, the giving out of appropriate information to interested private parties.

H. TAYLOR,

Major General, Chief of Engineers.

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., June 15, 1926.

Subject: Tennessee River and its tributaries.

To: The Chief of Engineers, United States Army.

1. A survey of certain sections of the Tennessee River basin was authorized by the acts of September 22, 1922, March 3, 1925, and April 15, 1926. The latter act contained the following clause:

Provided, That reports of such survey or surveys may be made to Congress from time to time, but the Engineer Department shall not give out information as to said surveys to other persons until after a report, partial or final, shall be made to the Congress.

2. As the survey is still in progress, and as the act of April 15, 1926, extended its scope, it is impracticable to make a final report at this time. The Chief of Engineers has however deemed it advisable to make available to Congress and to the public such data as have thus far been collected, and has directed the board to report thereon.

3. The work already accomplished includes the photographing, topographic surveying, and mapping of the Tennessee River proper between Chattanooga and Knoxville, Clinch River between Clinchport, Va., and the mouth, Powell River between Jonesville, Va., and the mouth, Big Pigeon River between Canton, N. C., and the mouth, French Broad River between Brevard, N. C., and the mouth of Nolichucky River, Hiwassee River between Hiwassee and the mouth, and Holston River between the mouth of Watauga River and Kingsport, Tenn. Detailed surveys have been made of nine dam sites.

4. Considerable additional areas have been covered in part, certain sections having been photographed, and others photographed and mapped; and work is actively in progress. The work yet to be done under existing authorizations covers sections of the main river, additional areas in the Clinch-Powell, Hiwassee, French Broad, Big Pigeon, Nolichucky, and Holston River basins, and studies of Duck River, Buffalo River, Elk River, Little River, Bear Creek, Tellico River, North Fork of the Tellico River, and the lower section of Little Tennessee River. All necessary stream flow records have been obtained, and are being kept up to date as the work progresses.

5. While the data already assembled will be of great value to anyone interested in power development in the Tennessee Basin, and should be made available for that purpose, the number of individuals who will desire such data will probably be quite limited. It is therefore undesirable to incur the large expense involved in printing all this material.

6. The board therefore recommends that there be transmitted to Congress the attached list of the maps, profiles, cross-sections, discharge tables, hydrographs, duration and backwater curves, tables of reservoir capacity, area and volume diagrams, and miscellaneous diagrams and tabulations completed to date. Persons desiring copies of any of these may obtain them from the United States district engineer, 40 Municipal Building, Chattanooga, Tenn., at the prices indicated in the attached list. It further recommends that there be transmitted the attached letter dated May 22, 1926, from the

district engineer, Chattanooga, containing in general a statement of the work under way, and of the situation in the Tennessee Valley as it appears to him.

7. It should be emphasized that this partial report is not to be construed in any way as a recommendation regarding the future action of Congress in the matter of power, navigation, or any other form of development or investigation in the Tennessee Basin. It is purely and simply a progress report, for the information of Congress and of interested parties generally.

For the board:

EDGAR JADWIN,
Brigadier General, Corps of Engineers,
Senior Member of the Board.

PARTIAL REPORT ON SURVEY OF TENNESSEE RIVER AND ITS TRIBUTARIES

UNITED STATES ENGINEER OFFICE,
Chattanooga, Tenn., May 22, 1926.

Subject: Partial report on survey of Tennessee River and its tributaries.

To: The Chief of Engineers, United States Army.

1. A preliminary examination of the Tennessee River and its tributaries in the interest of the maximum economic development of the water resources of that basin that might have a bearing of material importance to the interests of interstate navigation was authorized by the river and harbor act of June 5, 1920. Pursuant to this authority, a preliminary examination was made in the fall of 1920, and in 1921 a brief test of the methods recommended was made with a view to determining their practical value.

2. On May 18, 1922, the Secretary of War submitted to Congress reports on this examination and test which were printed as Document 319, House of Representatives, Sixty-seventh Congress, second session. In this it was recommended that a survey, to cost \$515,800, be made. With this report before it, Congress authorized such a survey, at a cost not to exceed \$200,000, and funds therefor became available in April, 1923. Work on the survey began promptly and about one year later, March 31 and April 1, 1924, the Committee on Rivers and Harbors of the House of Representatives held hearings on the question of extending the authorization of \$200,000 to the full amount recommended, \$515,800. With the report on these hearings before it, Congress granted this extension in the act approved March 3, 1925. In the act approved April 15, 1926, the authorization was extended to a total of \$790,800 and the scope of the survey was correspondingly increased.

3. Of the water resources of the Tennessee Basin only those relating to navigation alone had been extensively studied, and of the remainder that which clearly has the greatest influence on navigation is the potential hydroelectric development. Other resources have not been overlooked or neglected, but the importance of the hydroelectric possibilities has been such as inevitably to exert a

definite influence on the course of the survey. The magnitude and value of the various power possibilities in this basin vary between wide limits. At Muscle Shoals is a feasible project justifying a total installation of at least 840,000 horsepower, while at the other extreme could be found many brooks and rivulets where perhaps 1 or 2 horsepower only could be economically installed.

4. In planning this survey this situation was in mind when the recommendation was made "that these additional studies be as thorough as the law or the desires of Congress and available funds will permit." (Par. 200 (c), page 82, H. Doc. 319, 67th Cong., 2d sess.) The original estimate of cost, \$515,800, contemplated the study of power possibilities of sites to which were tributary drainage areas of about 1,000 square miles or more, this in addition to the other resources which should properly be considered. When the authorization of \$200,000 was made this was accepted as an indication that Congress desired the study of approximately 40 per cent of such possibilities. The extension of the authority to \$515,800 indicated that Congress desired the study of all the possibilities down to those with a limiting drainage area of about 1,000 square miles and the last extension to \$790,800 indicates, as stated in the act, that Congress now desires to extend the limit down "to include tributaries with a drainage of about 100 square miles."

5. The class of sites to be studied having been determined, the next question was to decide with what detail any individual site should be investigated. The structures, machinery, etc., required both by navigation and power are such as to require extensive and detailed investigation and plans before actual construction can be begun, and the cost of such studies, it was clear, would be far in excess of any amount that Congress might reasonably be asked to authorize. In addition it seemed evident that Congress now desires to know what are the water resources of this region in their relation to navigation and with this knowledge at hand it can thereafter decide on what structures it may desire to spend additional funds looking toward actual construction. For each site, therefore, it was planned to carry the present studies to that point where it could be established that feasible projects existed and that within proper economic limits power or other resources either could or could not contribute to the benefit of navigation, and the estimate of \$515,800 was based on this program.

6. The Federal water power act was approved June 10, 1920, and when the reports in Document 319 were written its influence on this situation had not yet become apparent. Since that time it has become evident, both in the Tennessee Basin and elsewhere, that private interests as permittees under that act are ready to carry on detailed studies at their own expense. Therefore, simply by establishing the general merit of a site Congress has the choice of making further appropriations for its detailed investigation and development or of permitting these things to be done at their own expense by private interests under the water power act. As a matter of fact, since the statistical data relating to specific sites became moderately complete, private interests in the Tennessee Basin have been anxious to assume the responsibility of accepting the economic values and of proceeding

with the detailed studies before the engineer department had announced or even formulated a definite opinion in the matter. This has already occurred at over 20 sites in this territory.

7. Information concerning the water resources is of particular value to the States lying in part within the Tennessee Basin, each of which has a technical service charged with the investigation of such matters though on a much smaller scale than that possible in this survey. Special effort has accordingly been made by the Engineer Department to avoid duplicating work done by these services or other agencies but rather to take full advantage of information of value that could properly be obtained from such other sources. Such cooperation was anticipated and the original estimates were based on that assumption, which has proved to have been well justified, particularly with the States of Tennessee and North Carolina. Cooperation has also been effected, as was also anticipated, from other Government departments, the United States Geological Survey, the Air Service, United States Army, the Department of Agriculture, etc., certain private agencies and the cities of Asheville, N. C., and Chattanooga, Tenn., this in accordance with pertinent laws and regulations. The value of the additional assistance thus obtained in connection with this survey is not less than \$63,000.

8. The activities required by this survey may be broadly grouped into three classes. One, the assembly of all statistical data pertaining to the flow of the principal streams at established gauging stations; another, the assembly of existing maps and the making of such additional ones as are necessary to arrive at a full understanding of the manner in which the flow of water may be controlled either in storage or in passing dams designed for power or for power and navigation; the third is the tentative location of power sites; the determination of the stream flow and head available at each site and the technical study of these data in order to arrive at a just understanding of the various possibilities which may thereby be disclosed. The map making operations have been the most conspicuous but no one of these groups can be said to be more important than either of the others.

9. When the first \$200,000 became available, adequate arrangements were made to secure the necessary stream-flow data at gauging stations throughout the basin and in addition it was found that the activities of Groups 2 and 3 could be undertaken for the basin of the Clinch and Powell Rivers, above the mouth of the Emory, and for the Tennessee proper from its source above Knoxville, Tenn., to Riverton, Ala., 30 miles below Muscle Shoals. Additional maps were required in the Clinch-Powell Basin, along the Tennessee from Knoxville to Chattanooga, and for small areas in the neighborhood of Gunter'sville and Riverton, Ala. (See index map.)¹ For the remainder, existing maps were adequate for present needs.

10. When the maps and stream-flow data were available for the Clinch, Powell, and Tennessee Rivers they were examined in the light of the needs and limitations of both power and navigation. Very promptly it became apparent that these interests could be best served by a system of 13 new dams. Of these five should be on the Clinch, one on the Powell, five on the Tennessee between Knoxville and

¹ Not printed.

Chattanooga, one between Muscle Shoals and Chattanooga near Guntersville, Ala., and one near Riverton below the foot of Colbert Shoals. (See index map.)¹ With these additional structures there seemed to be excellent reason to expect that provision could be made for a 9-foot depth for navigation from Riverton to Knoxville on the Tennessee, from the junction of the Tennessee and Clinch Rivers up the latter to the towns of Clinton and Coal Creek (about 75 miles), and from the junction of the Clinch and Emory Rivers up the latter to the town of Harriman and the immediate vicinity of important coal fields in that region.

11. With respect to the power side, it was at once evident from the nature of the terrain that three of these dams—one on the Powell and the two uppermost on the Clinch—would create large storage capacity and large power developments, the lower three on the Clinch should provide for navigation as well as for the development of power—with respect to power, these would be almost wholly dependent on the water discharged from the three storage dams above—and the seven dams on the Tennessee should be adapted to the needs of both power and navigation. The greater part of the water passing these seven dams would come from streams other than the Clinch and hence for the most part unregulated by storage. However, the capacity of the Clinch-Powell storage is so great that properly handled this storage can retain surplus high-water flow from the Clinch and make it available for use in the following low-water season. By this method of operation the minimum low-water power available at Guntersville, No. 3, Wilson Dam, and the Interstate Dam immediately below Riverton can be doubled and that at Hales Bar, Sherman, Soddy, and White Creek, the dams higher up (and below the mouth of the Clinch) can be more than doubled. Uniform discharge from this storage will not produce this result, since by that method water would be discharged from storage when there was already an excess flow in the Tennessee and would consequently not only be wasted there but tend to decrease the power at dams on the Tennessee below the mouth of the Clinch River, this by diminishing the head. On the other hand, water so wasted would not be available later to build up the low-water discharge throughout the entire system.

12. The foregoing conclusions were evident almost at once from even a brief consideration of the statistical data assembled by the survey, and, having been mentioned at the congressional hearing in the spring of 1924, they were duly noted by private companies interested in power developments in this region. These companies for a long time had tentative plans for the development of power in this neighborhood and the publication of these hearings by Congress seems to have awakened and extended this interest. In any event, by the fall of 1925, there were pending before the Federal Power Commission applications for permits for 12 of these 13 sites and it is known that the thirteenth is being carefully studied by a local power company.

13. In the meantime the engineer department has pursued its independent studies of this situation without as yet arriving at any final and definite conclusions. Should permits be issued these studies should be taken over by the permittees under the supervision

¹ Not printed.

of this department, this to the advantage of the public. As matters stand the studies of the survey indicate that the total installation at these 13 sites should be in round numbers 1,250,000 horsepower, and the costs should not be in excess of \$150 per horsepower, with navigation features included. This is under the assumption that these 13 sites form one project. If taken as separate projects, it is certain that one and perhaps others could not stand alone on their individual merits. In addition, it is to be remembered that the storage of this combination may be made to double the minimum low flow, both at the two plants at Muscle Shoals and at that now in operation at Hales Bar. The survey will continue to study the costs and installation for this series and have a definite statement to make in the final report. If these studies are in the meantime taken over by a permittee under the supervision of this office more thorough studies and accurate conclusions are to be expected because of the greater sums which such permittees might properly be required to devote to this matter. It is not expected that anything can be disclosed in the future to cause any radical change in the locations or general characteristics of these structures, for either power or navigation, this from the general outlines given in the documents listed in the appendix. Should further storage be disclosed later, on other tributaries, the effect will be to increase the power available from any installation that might now be adopted and perhaps to warrant some additional power installation for which, however, sufficient allowance can be made in any detailed plans that might now be worked out. Such additional storage could not have any adverse effect on navigation features that might be designed now.

14. When, by the act of March 3, 1925, the authorization of the survey was extended from \$200,000 to \$515,800, it was possible to extend the activities of this survey from the basin of the Clinch-Powell and the Tennessee proper to include the basins of the Holston, French Broad, and Hiwassee Rivers. These are three of the four major tributaries of the Tennessee above Muscle Shoals, the fourth being the Little Tennessee, for the complete power-storage development of which the Aluminum Co. has now very well-defined plans. Some work was also planned for the Duck River, this being the largest tributary joining the Tennessee below Muscle Shoals.

15. As matters stand, under the authorization limited to \$515,800 the necessary additional mapping operations are being carried on as indicated on the index map on the Holston, South Fork of the Holston, lower Watauga, French Broad, Big Pigeon, Nolichucky, and Hiwassee Rivers. Photographs¹ have also been secured, but no map work done, on the North Fork of the Holston, the lower Little Tennessee, Daddy Creek in the Emory Basin and on the Duck River. New maps have been completed on the Hiwassee River from above the Georgia line to the Tennessee River, the Big Pigeon from Canton, N. C., to its mouth, the French Broad from Brevard to below the junction of the Big Pigeon, a few sheets near Kingsport on the Holston, the Clinch from its mouth to the vicinity of Clinchport, Va., the Powell from its mouth to the vicinity of Jonesville, Va., the Emory to Harriman and the Tennessee from above Knoxville to Chattanooga with some additional work at Gunter'sville and between Muscle

¹ Not printed.

Shoals and Riverton. Office work is under way on the areas for which the field work has been completed on the Holston, Nolichucky, and French Broad.

16. Stream-flow records are substantially complete for the entire area included in the final authorization and will be kept up to date in the future as the work progresses. The nature and extent of such records now available is indicated in the appendix.

17. Power studies on the Clinch, Powell, and Tennessee Rivers have been carried as far as is now advisable in view of the recent extension of authority for the survey and the relation that additional power developments elsewhere may have to those already located in this basin. Studies of this nature will be made at all promising sites in the area mapped as indicated above. At present substantial progress has also been made along this line on the upper French Broad, the upper Big Pigeon and the upper Hiwassee. The nature and extent of this work is best shown by the records of work accomplished given in the appendix.

18. Under the final authorization of \$790,800, studies of the survey will be extended to include the entire area outlined on the index map, this to include the Tennessee proper between Riverton and Paducah.

19. The character of the results to be expected on the lower 100 miles of the Clinch and on the Tennessee River from Knoxville to Riverton has been very definitely indicated, as already outlined, by the work already done. What may be expected elsewhere is as yet for the most part uncertain, but some items have taken sufficiently definite form to warrant being mentioned at this time.

CLINCH-POWELL RIVERS

20. The two reservoirs at the head of the Cove Creek Reservoir, one on the Clinch and the other on the Powell, will have a combined available storage capacity of between 700,000 and 800,000 acre-feet. Their combined installed capacity will probably be about 120,000 horsepower. In addition to this generating capacity, this additional storage is important, particularly as it may be operated in connection with that of the Cove Creek Reservoir. With the three reservoirs operating in conjunction, there is much greater assurance that excess flood waters can be held over for several months to the period of drought. In some measure it should even be possible to hold water from a wet year or period of years into a dry year or period of years. The beneficial effects of these two upper reservoirs should be felt at the plants at Cove Creek, Clinton, Melton Hill, and Kingston on the Clinch and on the Tennessee from the mouth of the Clinch down through White Creek, Soddy, Sherman, Hales Bar, Gunter'sville, No. 3, Wilson Dam, and Interstate below Riverton, provided the plants there were operated with due regard to the possibilities and limitations of this stored water. Under the authority as extended by the act of April 15, 1926, the survey will include the Emory Basin, the Powell above Jonesville, Va., and the Clinch above Clinchport, Va., as shown on the index map.¹

¹ Not printed.

HIWASSEE RIVER

21. Although on the program, it has not yet been possible to give proper study to the item of costs on this river, particularly where flowage damages are concerned. These will be high, since they involve good farm land, concrete highways, railroads, etc. However, the general investigation of this subject indicates that the quantity of power to be obtained will be great enough to pay these costs unless they are permitted to go to unreasonable limits. With this condition in mind the following statements are permissible.

22. A favorable dam site, the Tusquitee site, seems to be available on the Hiwassee River just below the mouth of the Tusquitee Creek, about 9 miles north of the Georgia-North Carolina State line, and about 40 miles in an air line from the Tallulah Falls plant of the Georgia Railway & Power Co., on the Tallulah River. The Tusquitee dam would form a reservoir, whose surface would be about 1,900 feet above sea level. Since the mouth of the Hiwassee (in the Soddy pool) is at elevation 676 and the tailwater elevation of the Interstate Dam is about 360 feet above sea level, water from this reservoir would fall through a head of over 1,200 feet in reaching the Tennessee and of over 1,500 feet in passing the vicinity of Riverton. About 18 miles farther down the Hiwassee there seems to be another favorable site, the Murphy site, about 1 mile above the town of Murphy. About midway between Murphy and the North Carolina-Tennessee State line there seems to be a third favorable site, the Coleman site, while at the State line there seems to be a fourth site, the Apalachia site. These four dams, with perhaps a fifth intermediate between the Tusquitee and Murphy sites, should develop all the head from elevation 1,900 to elevation 1,150. They should, combined, provide a total available storage capacity in the neighborhood of 850,000 acre-feet.

23. In the 22 miles below Apalachia to the vicinity of Wetmore, the Hiwassee flows through a narrow gorge and descends 430 feet to about elevation 720. In this section power dams can seemingly be built at almost any point desired and definite sites will not be investigated until further study by the survey shows what number should be built to develop the head with maximum economy. Throughout this section the river is closely paralleled by a railroad, but it is hoped that this can be eliminated as an obstacle within permissible costs. Very little storage will be possible in this gorge section.

24. About 20 miles below Wetmore the Hiwassee enters the pool of the proposed Soddy dam on the Tennessee at elevation 676. This 44-foot fall can probably be developed for power in two low-lift dams, and flow at them would be augmented by the discharge from the Ocoee River, which joins the Hiwassee in this section. A single dam would be preferable, but present indications are that flowage would be too expensive. The Tennessee Electric Power Co. has now two storage reservoirs and expects ultimately to have five storage reservoirs on the Ocoee, so that this additional regulated flow would be of material importance. Locks could be put at these two low dams if the interests of navigation warranted, something which is not now apparent.

25. Private interests have been active in the power development of the Hiwassee River above Wetmore for 10 years or more, this to the extent of making plans, acquiring property and flowage rights, and carrying on extended litigation over these rights. None of them have yet begun construction. The town of Andrews, N. C., has recently built a run of river plant within the area of the proposed Murphy reservoir. It provides no storage of importance. Some of the power interests are applicants for preliminary permits before the Federal Power Commission, others are not, and the extent to which the commission may exercise authority over this section is now in dispute. Properly developed and controlled Hiwassee storage should add between 1,000 and 2,000 cubic feet per second to the low-water flow of the Tennessee at Soddy, Sherman, Hales Bar, Gunter'sville, No. 3, Wilson Dam, and Interstate power plants. Improperly developed or controlled, this potential benefit to power development will be correspondingly reduced, and the proportion of costs chargeable to navigation at these Tennessee River sites will be increased. The most probable total hydroelectric installation for all the various sites above Wetmore is about 350,000 horsepower.

26. Under the authority as extended by the act of April 15, 1926, the survey will include the Hiwassee proper above the limits now mapped, Conasauga Creek, Coker Creek, Nottely River, and Brass-town Creek. In some cases rather small drainage areas are compensated for by unusually high heads.

LITTLE TENNESSEE

27. In paragraph 94, page 51, House Document No. 319, Sixty-seventh Congress, second session, and on page 96, House Document No. 119, Sixty-ninth Congress, first session, will be found references to the 460,000 horsepower project of the Aluminum Co. of America for the upper section of this river. Of this project the Cheoah Dam is completed and in operation and the Santeetlah is under construction. No activities for the survey have at any time been considered for this section, this because of the comprehensive nature of the plans already formulated by the Aluminum Co.

28. Under former authority aerial photographs were taken of the lower section of the Little Tennessee from its mouth up to the existing project of the Aluminum Co. Under the authority as extended by the act of April 15, 1926, the survey will include this lower section, also the Tellico River and the North Fork of the Tellico River.

BIG PIGEON RIVER

29. This river has been mapped by the survey from Canton, N. C. to its mouth. The Cataloochee-Waterville project has been formulated by the Pigeon River Power Co. as a permittee under the Federal water power act and this company is now an applicant for a license to construct this project. Much of its investigation was done here before the governmental survey for this river was authorized. The complete study of the mapped section is on the survey program but has not yet been reached. In addition to the pending project the survey recognizes the following possibilities as worthy of careful study.

30. A favorable dam site can probably be found on the Big Pigeon immediately below the mouth of Jonathan Creek, Jonathan site, or at some point between that site and the head of the reservoir formed by the project dam in the Big Pigeon immediately below the mouth of Cataloochee Creek. Such a dam should form a reservoir having a maximum surface elevation at about 2,580 feet above sea level, about 2,220 feet above tailwater of the Interstate dam below River-ton on the Tennessee, and about 320 feet above the Cataloochee Reservoir. The Jonathan Reservoir should have an available storage capacity of about 250,000 acre-feet. It involves the overflow of good farm land, concrete highways, railroads, and some small villages. The area of the reservoir would be about 6,800 acres. It would form an artificial lake lying immediately adjacent to the eastern boundary of the proposed Great Smoky Mountain National Park, it would be close to the nationally known tourist city of Asheville and would be surrounded by the high mountain peaks of that section. For this reason its scenic value should be appreciable.

31. Below Waterville the Big Pigeon descends about 400 feet before joining the French Broad. Favorable dam sites for the development of about the first 250 feet of this descent as a power head should be located without difficulty. A declaration of intention for one dam in this section is now on file before the Federal Power Commission. No specific sites have as yet been fixed either by the survey or other agency. It is hoped that the survey study of the lower 150 feet of fall will disclose feasible power projects. In this lowest section the results can not yet be predicted with assurance.

32. The Jonathan reservoir would add about 480 cubic feet per second to the minimum low-water flow through the Cataloochee-Waterville plants which develop a head of about 800 feet and to such additional plants as may later be found feasible on the lower Big Pigeon and the lower French Broad, also to the following plants on the Tennessee River, Coulter Shoals, Marble Bluff, White Creek, Soddy, Sherman, Hales Bar, Gunter'sville, No. 3, Wilson Dam, and Interstate. If this reservoir can be given due credit for the benefit which it would contribute to these plants it would appear that its high cost can be fully justified. The subject deserves the additional study which it is planned to give it. No additional work under the authority of the act of April 15, 1926, is needed in the basin of this tributary.

FRENCH BROAD

33. This river has been mapped by the survey from Brevard downstream to a point below the junction of the Big Pigeon and maps to its junction with the Tennessee River will be completed at an early date. The complete study of the mapped section is on the survey program, but has not yet been reached. The following possibilities are recognized as worthy of careful study.

34. A favorable dam site can probably be found on the French Broad about 3 miles above the city of Asheville, the Asheville site. A dam here should form a reservoir having a maximum surface elevation of about 2,100 feet above sea level, about 1,750 feet above tailwater at the Interstate Dam, and about 1,300 feet above the pool of the Coulter Shoals Dam below Knoxville on the Tennessee. A head of about 130 feet could be obtained at the Asheville Dam; in the next

70 miles downstream the river descends about 1,000 feet and from the mouth of the Big Pigeon descends another 200 feet in reaching the Tennessee. Power should be developed at the dam. Throughout the 70-mile stretch with its 1,000 feet fall the river is closely paralleled by a railroad located but a short distance above the high-water line. With flood discharge reduced by the Asheville reservoir storage above, it is hoped that by a series of low dams, some tunnels and flumes most, if not all, this head may be utilized for power without undue interference with the railroad. No other feasible scheme for the elimination of this railroad as an obstacle to power development has yet been suggested. Between the mouth of the Big Pigeon and the Tennessee it is hoped that sites can be found for dams of moderate height, such as to permit the fall of 200 feet to be used for power development. Locks for navigation can be considered in this section.

35. The Asheville Reservoir should have an available storage capacity of nearly 1,000,000 acre-feet. It would add about 1,400 cubic feet per second to the minimum low water flow throughout the 1,300 feet descent between the reservoir and the Tennessee River, and to the minimum low water flow at the following plants on the Tennessee River: Coulter Shoals, Marble Bluff, White Creek, Soddy, Sherman, Hales Bar, Gunter'sville, No. 3, Wilson Dam, and Interstate. This reservoir would have an area of over 30,000 acres, and the flowage damages caused thereby would doubtless be more than could be borne by the power developed at the 130-foot dam creating it. If it can be given due credit for the benefit which it would contribute to the plants above indicated, it is hoped that its cost can be justified. This reservoir would form a lake having a sufficient depth for navigation extending from Asheville to Hendersonville and to near Brevard, it would be surrounded by the mountains which have helped to give this region a national reputation as a tourist center. It is believed that this scenic setting and local navigation would have an appreciable value. This region suffered from a water famine in 1925. With this reservoir no such famine could occur. These facts warrant the study which the survey will make of this region.

36. Under the authority as extended by the act of April 15, 1926, the survey will also include the following tributaries to the French Broad: Little Pigeon River and Big Creek.

NOLICHUCKY

37. The program for the survey calls for the study of the possibilities of the Nolichucky from the vicinity of Embreeville to its junction with the French Broad. Field map work is now under way on this river and no office work has been begun, and accordingly its possibilities can not yet be discussed with any degree of assurance.

38. Under the authority as extended by the act of April 15, 1926, the survey will also include the following: North Toe River, South Toe River, Cane Creek, and the Nolichucky above Embreeville. Declarations of intention are on file with the Federal Power Commission for power development in the region which includes the streams listed

HOLSTON

39. The program for the survey calls for the study of the possibilities of the Holston River from a point in Virginia east of Bristol to its junction with the Tennessee River, including a section of the lower Watauga River. Field map work of this section has been completed and a few map sheets have been finished as indicated on the index map. This work has not yet progressed to the point where the possibilities of the region can be discussed with any degree of assurance. There is pending before the Federal Power Commission an application for a preliminary permit for three power-storage dams in the Holston River in the section immediately above Kingsport and covered by the map work of the survey.

40. Under the authority as extended by the act of April 15, 1926, the survey will also include the North Fork of the Holston from its mouth near Kingsport, Tenn., upstream to the vicinity of Saltville, Va.

TENNESSEE RIVER

41. Suitable reference has been made above to the work so far accomplished on the Tennessee proper. Under the authority as extended by the act of April 15, 1926, the survey will now include consideration of the section between Riverton, Ala., and Paducah, Ky.

OTHER TRIBUTARIES

42. Under the authority as extended by the act of April 15, 1926, the survey will now include consideration of the appropriate water resources of the Little River, joining the Tennessee a short distance below Knoxville; the Elk River, joining the Tennessee from the north in the Muscle Shoals section; Bear Creek, joining the Tennessee from the south near Riverton; the Duck River, joining the Tennessee from the east in western Tennessee; and Buffalo River, the principal tributary of the Duck and joining it near its mouth.

43. The cost of any individual project and the generating capacity which should be installed there are matters requiring detailed study, and the cost of such studies usually amounts to between \$3 and \$1 per horsepower of installation, the lower cost ordinarily corresponding to the larger installation. Since this survey is expected to disclose possible power projects in excess of 2,000,000-horsepower installation it will be evident that complete detailed studies of them would cost from \$2,000,000 to \$6,000,000. It has never been proposed that the present survey should undertake this expensive detailed work. The purpose of this survey is only to determine for each site considered whether a development there for power or power and navigation is physically and economically justifiable under the assumption that power developed could be marketed at current rates. Actual development will also be dependent on the growth of the market or demand for power.

44. The estimates of cost and installation given in the following table are therefore very general and constant effort is made to keep estimates of installed capacity conservative. Cost estimates are omitted where studies have progressed only so far as to show that these sites are worthy of further studies. The following table is a

preliminary estimate of the undeveloped hydroelectric power possibilities of that part of the Tennessee basin covered by the survey up to April 15, 1926. This is based on data assembled by the survey prior to that date and also on estimates made by private power companies. No estimate is yet made of the French Broad and Holston and their tributaries or of other smaller streams. All figures for installation and cost are tentative and subject to revision in future partial or final reports.

Site	Installation, horse-power	Cost	Site	Installation, horse-power	Cost
Interstate.....	260,000	\$25,000,000	Melton Hill.....	60,000	\$8,000,000
No. 3, Muscle Shoals.....	165,000	32,000,000	Clinton.....	15,000	2,000,000
Guntersville.....	160,000	15,000,000	Cove Creek.....	200,000	20,000,000
Sherman.....	45,000	6,000,000	War Ridge.....	80,000	-----
Soddy.....	150,000	13,000,000	Cumberland Gap.....	40,000	-----
White Creek.....	150,000	13,000,000	Hiwassee River sites.....	350,000	-----
Marble Bluff.....	70,000	9,000,000	Little Tennessee sites (Aluminum Co.).....	390,000	-----
Coulter Shoals.....	75,000	10,000,000	Big Pigeon sites.....	160,000	-----
Kingston.....	50,000	6,000,000			

45. The appended list of statistical data assembled to date by this survey indicate the nature and extent of the work so far accomplished. These data are available for public use upon the prepayment of the reproduction costs stated. In this appended list of over 600 sheets of available documents are included those such as records of stream discharge, etc., which give fundamental data on which the work of the survey is based, also map sheets, hydrographs, etc., which give the same data in the form in which it is actually used in the third step or studies of the survey. There is a large amount of work involved in passing from the recorded data as received from the field to that in which these data appear in usable form, and the completeness and accuracy of the work of this intermediate stage is a factor of vital importance to the survey. There are on file in the Chattanooga office over 1,100 sheets varying in size from 8 by 9½ inches to 25 by 70 inches on which are preserved the essential records of this intermediate stage, also over 6,000 contoured photographs. These sheets and photographs have not been put in form for reproduction because it was believed that the cost of so doing was not justified. This decision was based on the fact that while these data are of material value and interest to the few engaged in making and checking studies of the development of water resources, yet they would be of little general interest. However, these data form an integral part of this report to the extent that certain statements herein contained are based on such data and it is believed that it is in the public interest that congressional authority be granted for the exhibition of such data to such interested parties as may desire to examine them in this office, not only for the information thus given but also in order that this work may benefit by the constructive criticism which may thus be evoked.

HAROLD C. FISKE,
Major, Corps of Engineers, District Engineer.

APPENDIX

Maps, profiles, and cross-sections

TENNESSEE RIVER

	Size	Scale	Price per print
1 index map of topographic sheets.....	27 by 40 inches..	1:125,000.....	\$0.50
20 topographic sheets, head of river to Chattanooga, Tenn.....	.....do.....	1:15,000.....	.50
1 topographic sheet, vicinity of Guntersville, Ala.....	.....do.....	1:15,000.....	.50
1 sheet, plane table survey of dam site at foot of Colbert Shoals.....	27 by 40 inches..	1:4,800.....	.50
2 sheets, Florence to Riverton, Ala. (made by U. S. Geological Survey).....	.....do.....	1:24,000.....	.50
1 detail survey, Guntersville Dam site.....	.....do.....	1:2,400.....	.50
1 detail survey, Sherman Dam site.....	.....do.....	.....do.....	.50
1 detail survey, White Creek Dam site.....	.....do.....	.....do.....	.50
1 detail survey, Marble Bluff Dam site.....	.....do.....	.....do.....	.50
1 detail survey, Coulter Shoals Dam site.....	.....do.....	.....do.....	.50
6 profile sheets, head of river to Chattanooga, Tenn.....	.....do.....	Horizontal, 1 inch to 1 mile; vertical, 1 inch to 4 feet.	.50

CLINCH RIVER

21 topographic sheets, Clinchport, Va., to mouth of river.....	27 by 40 inches..	1:15,000.....	\$0.50
1 vicinity map, Cove Creek reservoir.....	.....do.....	1:125,000.....	.50
1 detail survey, Senator Dam site.....	.....do.....	1:2,400.....	.50
1 detail survey, Clinton Dam site.....	.....do.....	.....do.....	.50
1 detail survey, Cove Creek Dam site.....	.....do.....	.....do.....	.50
5 profile sheets, Southern Ry. bridge, Middlesboro-Knoxville division to mouth of river (137 miles).....	.....do.....	Horizontal, 1 inch to 1 mile; vertical, 1 inch to 4 feet.	.50
1 cross section, Cove Creek site.....	22 by 34 inches..	Horizontal, 1 inch to 100 feet; vertical, 1 inch to 20 feet.	.35

POWELL RIVER

9 topographic sheets, near Jonesville, Va., to mouth of river (sheet P-1 is counted with Clinch as sheet C-8).....	27 by 40 inches..	1/15,000.....	\$0.50
5 profile sheets, Jonesville, Va., to mouth of river.....	.....do.....	Horizontal 1 inch to 1 mile, vertical 1 inch to 4 feet.	.50

BIG PIGEON RIVER

6 topographic sheets, Canton, N. C., to mouth of river.....	27 by 40 inches..	1/15,000.....	\$0.50
10 profiles, Canton, N. C., to mouth of river.....	.....do.....	Horizontal 1 inch to ½ mile, vertical 1 inch to 8 feet.	.50
1 cross section, Teague site.....	22 by 34 inches..	Horizontal 1 inch to 100 feet, vertical 1 inch to 20 feet.	.35

FRENCH BROAD RIVER

16 topographic sheets, Brevard, N. C., to below mouth of Nolichucky River.....	27 by 40 inches..	1/15,000.....	\$0.50
10 profile sheets, Brevard, N. C., to 3 miles below Leadville, Tenn.....	.....do.....	Horizontal 1 inch to ½ mile, vertical 1 inch to 8 feet.	.50
1 cross section Asheville site.....	22 by 34 inches..	Horizontal 1 inch to 100 feet, vertical 1 inch to 10 feet.	.35

Maps, profiles, and cross-sections—Continued

HIWASSEE RIVER

	Size	Scale	Price per print
14 topographic sheets; mouth of river is shown on Tennessee 13.	27 by 40 inches	1/15,000	\$0.50
1 detail survey, Tusquitee dam site (not traced)	do	1/2,400	.50
9 profile sheets, bridge above Fodder Creek (3 miles above Hiwassee, Ga.) to mouth of river.	do	Horizontal 1 inch to 1/2 mile, vertical 1 inch to 8 feet.	.50

HOLSTON RIVER

4 topographic sheets, mouth of Watauga River to Kingsport, Tenn.	27 by 40 inches	1/15,000	\$0.50
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Index map showing tentative sites, etc., and extent of field mapping operations, price \$1.00.

In addition there are 9,180 aerial photographs taken along the river listed above. War Department orders forbid issuance of these photographs to the public.

Bulletin 34, Division of Geology, State of Tennessee, "Water Resources of Tennessee."

Bulletin No. 34, North Carolina Department of Conservation and Development, "Discharge Records of North Carolina Streams, 1889-1923."

TABLES OF DAILY DISCHARGE

Project	Number	Years of record	Size	Cost each (blue-print)
Riverton	30	1895-1924	11 by 16½ inches	\$0.08
Sherman	2	Composite and median years	do	.08
Soddy Creek (Sale Creek)	26	1900-1924, composite year	do	.08
White Creek	22	1905-1924, composite and median years	do	.08
Marble Bluff	22	1905-1924, composite and median years	do	.08
Coulter Shoals	27	1900-1924, composite and median years	do	.08
Senator	21	1904-1924	do	.08
Melton Hill	21	1904-1924	do	.08
Clinton	21	1904-1924	do	.08
Cove Creek	22	1904-1924, composite year	do	.08
War Ridge	23	1904-1924, composite and median years	do	.08
Cumberland Gap	24	1904-1925, composite and median years	do	.08
Asheville	21	1904-1924	do	.08
Teague	23	1903-1924	do	.08
Holston No. 3	25	1901-1925	do	.08
Holston No. 2	23	1901-1923	do	.08
Holston No. 1	24	1901-1924	do	.08

TABLES OF MONTHLY DISCHARGE

Guntersville	1	1900-1924, with composite year	11 by 16½ inches	\$0.08
Tusquitee	1	1898-1925	do	.08

HYDROGRAPHS

Project	Number	Years of record	Size	Cost each (blue-print)
Florence.....	1	Daily, 1904-1924.....	25 inches by 74 feet.	\$6. 25
Guntersville.....	1	Monthly, 1900-1924.....	25 inches by 14 feet.	1. 25
Sherman.....	1	Daily, 1900-1924.....	25 inches by 85 feet.	7. 25
Do.....	1	Composite year, 1900-1924.....	25 inches by 3 feet 6 inches.	. 45
Do.....	1	Median year, 1900-1924.....	do.....	. 45
Soddy Creek.....	1	Daily, 1900-1924.....	25 inches by 82 feet.	7. 00
Sale Creek.....	1	Composite year, 1900-1924.....	25 inches by 5 feet.	. 50
White Creek.....	1	Daily, 1905-1924.....	25 inches by 64 feet.	5. 25
Marble Bluff.....	1	do.....	do.....	5. 25
Coulter Shoals.....	1	Daily, 1900-1924.....	25 inches by 82 feet.	7. 00
Do.....	1	Monthly, 1900-1924.....	25 inches by 7 feet.	. 75
Do.....	1	Daily, modified by Asheville, 1904.....	25 inches by 4 feet.	. 50
Do.....	1	Daily, modified by Asheville, 1911.....	do.....	. 50
Cove Creek.....	1	Daily, 1904-1924.....	25 inches by 69 feet.	6. 00
Do.....	1	Composite year, 1904-1924.....	25 inches by 5 feet.	. 50
War Ridge.....	1	Daily, 1904-1924.....	25 inches by 67 feet.	6. 00
Cumberland Gap.....	1	Daily, 1904-1925.....	25 inches by 75 feet.	6. 25
Murphy.....	1	Comparison: Natural with modified by Tusquitee by months, 1898-1925.	25 inches by 7 feet.	. 75

DURATION CURVES

Project	Number	Years of record	Size	Cost each (white print)
Riverton.....	1	Daily, natural flow, 1895-1924.....	24 by 27 inches..	\$0. 40
Do.....	1	Comparative duration curve; natural and as modified by Cove Creek Reservoir.	do.....	. 40
Guntersville.....	1	Daily, natural flow, 1875-1924.....	do.....	. 40
Do.....	1	Monthly, natural flow, 1900-1924.....	do.....	. 40
Do.....	1	Comparative duration curve; natural flow and as modified by Cove Creek Reservoir.	do.....	. 40
Sherman.....	1	Daily and monthly natural flow, 1875-1924.....	do.....	. 40
Do.....	1	Comparative duration curve; natural flow and as modified by Cove Creek Reservoir.	do.....	. 40
Do.....	1	Comparative duration curve; natural flow for periods 1875-1924 and 1900-1924.	do.....	. 40
Soddy Creek.....	1	Daily, natural flow, 1900-1924.....	do.....	. 40
(Sale Creek).....	1	Comparative duration curve; natural flow and as modified by Cove Creek Reservoir.	do.....	. 40
White Creek.....	1	do.....	do.....	. 40
Marble Bluff.....	1	Daily, natural flow, 1905-1924.....	do.....	. 40
Coulter Shoals.....	1	Daily, natural flow, 1900-1924.....	do.....	. 40
Senator.....	1	Daily, natural flow, 1904-1923.....	do.....	. 40
Clinton.....	1	do.....	do.....	. 40
Laurel.....	1	Daily, natural flow, 1895-1925.....	do.....	. 40

RESERVOIR CAPACITIES

Project	Number	Description	Size	Cost each (blue print)
Cove Creek.....	2	Tabulation of areas and volumes by 10-foot contour intervals.	8 by 10½ inches.	\$0.03
War Ridge.....	1	do.....	do.....	.08
Cumberland Gap.....	1	do.....	do.....	.08
Asheville.....	1	do.....	do.....	.08
Teague.....	2	do.....	do.....	.08
Cataloochee.....	1	do.....	do.....	.08
Tusquitee.....	1	do.....	do.....	.08
Murphy.....	1	do.....	do.....	.08
Coleman.....	1	do.....	do.....	.08
Apalachia.....	1	do.....	do.....	.08

CROSS SECTIONS AT DAM SITES

Project	Number	Description	Size	Cost each (white print)
Cove Creek.....	1	Diagram showing cross section at dam site..	21 by 32 inches..	\$0.40
Asheville.....	1	do.....	do.....	.40
Teague.....	1	do.....	do.....	.40

AREA AND VOLUME DIAGRAM

Project	Number	Description	Size	Cost each (blue print)
Cove Creek.....	1	Curves showing volumes in reservoir.....	24 by 36 inches..	\$0.45
War Ridge.....	1	Area and volume of reservoir.....	21 by 32 inches..	.40
Tusquitee.....	1	do.....	24 by 29 inches..	.40
Murphy.....	1	do.....	21 by 32 inches..	.40

MISCELLANEOUS DIAGRAMS

Project	Number	Years of record	Size	Cost each (white print)
Cove Creek.....	1	Comparative powergraphs: Dams No. 2 and 3, Muscle Shoals alone and combined with Cove Creek for 1914.	25 inches by 5 feet.	\$1.00
	1	Comparative powergraph: Dams No. 2 and 3, Muscle Shoals alone and combined with Cove Creek for 1911.	do.....	1.00
	1	Comparative powergraph: Dams No. 2 and 3, Muscle Shoals and Cove Creek and the combined total with river discharge regu- lated by Cove Creek Reservoir; also show- ing elevation of surface of Cove Creek Reservoir, 1904-1924.	25 inches by 7 feet.	1.25
	1	Comparative powergraph: Dam No. 2, Muscle Shoals, power with natural flow and as modified by Cove Creek for 1911 and 1914.	22 inches by 5 feet.	.75
	1	Diagram showing drawdown and power developed, 1904-1923.	24 inches by 7 feet.	.84
Asheville.....	1	Mass curve, 1896-1924, by months. Tabu- lation of results; case I and II as shown on Asheville mass curve.	25 inches by 7 feet.	.75
Teague.....	1	Mass curve, 1903-1925, by months.....	25 inches by 6 feet.	.75
Florence.....	1	Curve showing comparison of gauge heights with Decatur.	24 by 28 inches..	.40
Guntersville.....	1	Power curve showing power on natural and modified flow.	24 by 27 inches..	.40

BACKWATER CURVES

	1	Showing backwater conditions at all Tennes- see River projects from Sherman to head- waters.	22 inches by 6 feet.	\$0.65
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TABLES SHOWING YEARLY MAXIMUM, MINIMUM, AND MEAN STREAM DISCHARGE

Project	Number	Years of record	Size	Cost each (blue print)
Riverton	1	1895-1924	8 by 10½ inches	\$0.08
Guntersville	1	1900-1924	do	.08
Soddy Creek (Sale Creek.)	1	1900-1924	do	.08
White Creek	1	1905-1924	do	.08
Marble Bluff	1	1905-1924	do	.08
Coulter Shoals	1	1900-1924	do	.08
Senator	1	1904-1924	do	.08
Melton Hill	1	1904-1924	do	.08
Clinton	1	1904-1924	do	.08
Cove Creek	1	1904-1924	do	.08
War Ridge	1	1904-1924	do	.08
Cumberland Gap	1	1904-1923	do	.08
Holston No. 1	1	1901-1923	do	.08
Holston No. 2	1	1901-1923	do	.08
Holston No. 3	1	1901-1923	do	.08
Asheville	1	1904-1924	do	.08
Teague	1	1903-1924	do	.08
Tusquitee	1	1898-1923	do	.08
Coleman	1	1898-1924	do	.08
Apalachia	1	1898-1924	do	.08

MISCELLANEOUS TABULATIONS

Table showing location by mileages, elevations of upper and lower pools, heads available and length of pools for the following projects:

Interstate, Dam No. 1 (Muscle Shoals), Dam No. 2 (Wilson Dam), Dam No. 3 (Muscle Shoals), Guntersville, Widows Bar, Hales Bar, Sherman, Soddy Creek, White Creek, Marble Bluff, Coulter Shoals, Senator, Melton Hill, Clinton, Cove Creek, War Ridge, Cumberland Gap.



Project	Number	Years of record	Size	Cost each (blue print)
Riverton	1	1895-1924	8 by 10½ inches	\$0.08
Guntersville	1	1900-1924	do	.08
Soddy Creek (Sale Creek.)	1	1900-1924	do	.08
White Creek	1	1905-1924	do	.08
Marble Bluff	1	1905-1924	do	.08
Coulter Shoals	1	1900-1924	do	.08
Senator	1	1904-1924	do	.08
Melton Hill	1	1904-1924	do	.08
Clinton	1	1904-1924	do	.08
Cove Creek	1	1904-1924	do	.08
War Ridge	1	1904-1924	do	.08
Cumberland Gap	1	1904-1923	do	.08
Holston No. 1	1	1901-1923	do	.08
Holston No. 2	1	1901-1923	do	.08
Holston No. 3	1	1901-1923	do	.08
Asheville	1	1904-1924	do	.08
Teague	1	1903-1924	do	.08
Tusquitee	1	1898-1923	do	.08
Coleman	1	1898-1924	do	.08
Apalachia	1	1898-1924	do	.08

BACKWATER CURVES

1	Showing backwater conditions at all Tennessee River projects from Sherman to head of river.	22 inches by 30 inches	\$0.08
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